We claim:

1. A method of forming a low dielectric constant structure, comprising the steps of:
   - providing on a substrate a dielectric material having a first elastic modulus; and
   - curing the dielectric material whereby the material is heated from a first temperature to a second temperature by increasing the temperature at an average rate of 1 °C per second or more, to produce a dielectric material having a second elastic modulus, which is greater than the first elastic modulus.

2. The method according to claim 1, wherein the temperature difference between the second and the first temperature is at least 200 °C.

3. The method according to claim 2, wherein the temperature difference between the first and second temperature is in the range of from 225 to 425 °C.

4. The method according to claim 3, wherein the temperature difference between the first and second temperatures is at least 300 °C.

5. The method according to claim 1, wherein the dielectric material is heated to a second temperature by increasing the temperature at an average rate of 1 °C per second or more.

6. The method according to claim 5, wherein the dielectric material is heated to a second temperature by increasing the temperature at an average rate of from 10 to 50 °C per second.

7. The method according to claim 1, wherein the first temperature is room temperature.

8. The method according to claim 1, wherein the temperature is increased over a time period of 5 minutes or less.

9. The method according to claim 8, wherein the increase in temperature occurs over a time period of 1 minute or less

10. The method according to claim 1, wherein the temperature is increased from the first temperature to the second temperature at a heating rate of at least 10 °C per second.

11. The method according to claim 10, wherein the heating rate is at least 30 °C per second.

12. The method according to claim 1, wherein the dielectric constant of the dielectric material is 2.60 or less.

13. The method according to claim 12, wherein the dielectric constant of the dielectric material after curing is 2.50 or less.

14. The method according to claim 13, wherein the dielectric constant of the dielectric material after curing is 2.40 or less.

15. The method according to claim 1, wherein the porosity of the dielectric material is less than 30 %.

16. The method according to claim 1, wherein the porosity of the dielectric material is less than 15 %.

17. The method according to claim 1, wherein the average pore-size is less than 1 nm.

18. The method according to claim 1, wherein the Young's modulus of the film is higher than 4 GPa after curing.

19. The method according to claim 18, wherein the Young's modulus of the film is higher than 5 GPa after curing.

20. The method of claim 1, wherein the change in elastic modulus is 4 GPa or higher.

21. The method according to claim 1, wherein substrate is a semiconductor substrate.

22. The method of claim 21, wherein the dielectric material is provided on said semiconductor substrate in alternating areas with an electrically conductive material.

23. The method of claim 22, wherein the electrically conductive material comprises aluminum.

24. The method of claim 23, wherein the electrically conductive material comprises copper.

25. The method of claim 22, wherein the alternating areas are formed by depositing and patterning the dielectric material, followed by depositing the electrically conductive material.

26. The method of claim 25, wherein the depositing of the dielectric material and electrically conductive material is part of a copper damascene process.

27. The method of claim 22, wherein the alternating areas are formed by depositing and patterning the electrically conductive material, followed by depositing the dielectric material.

28. The method according to claim 1 or 21, wherein the dielectric material is deposited on the substrate by a spin-on process.

29. The method according to claim 1 or 21, wherein the dielectric material is deposited on the substrate by spray-on or dip coating.

30. The method according to claim 1 or 21, wherein the dielectric material is deposited on the substrate by chemical vapor deposition.

31. The method according to claim 1, wherein the dielectric material comprises a siloxane material.

32. The method according to claim 1, wherein the dielectric material is an inorganic material.

33. The method according to claim 1, wherein the dielectric material is an organic/inorganic monomeric or polymeric material.

34. The method of claim 33, wherein the organic/inorganic material is a poly(organo)siloxane.

35. The method according to claim 1, wherein the dielectric material is an organic material.

36. The method according to claim 35, wherein the dielectric material is an organic polymer selected from the group of poly(arylene ethers), fluorinated poly(arylene ethers), polyimides or fluorinated polyimides, Parylene-N or Parylene-F, SiLK or Cyclotene.-

37. The method according to claim 33, wherein the dielectric material is an organic/inorganic polymer selected from the group of Black Diamond, Black Diamond II, Coral or diamond-like carbon.

38. The method according to claim 32, wherein the dielectric material is an inorganic material selected from the group of hydrogen silsesquioxane or fluorosilicate glass (FSG).

39. The method according to claim 33, wherein the dielectric material is an organic/inorganic polymer selected from the methylsilsesquioxane, phenylsilsesquioxane, methylphenylsilsesquioxane, methylvinylsilsesquioxane, phenylvinylsilsesquioxane, vinylsilsesquioxane or methylpheneylvinylsilsesquioxane.

40. The method according to claim 33, wherein the dielectric material is an organic/inorganic polymer selected from the adamantyl or adamantyl derivative containing silsesquioxane.

41. The method according to claim 33, wherein the dielectric material is an organic/inorganic polymer selected from the perfluorinated or partially fluorinated aryl, alkyl or aryl-alkyl containing silsesquioxane.

42. The method according to claim 1, wherein the dielectric material under cure is a low molecular weight polymer having molecular weight between 1,000 – 10,000 g/mol.

43. The method according to claim 1, wherein the dielectric material under cure is a high molecular weight polymer having molecular weight between 10,000 – 100,000 g/mol.

44. The method according to claim 1, wherein the dielectric material under cure is a combination of low and high molecular weight polymers having molecular weight between 1,000 – 10,000 g/mol and 10,000 – 100,000 g/mol.

45. The method according to claim 1, wherein the dielectric material under cure contains thermally labile porogens.

46. The method according to claim 34, wherein the silsesquioxane material is selected from hydrogen silsequioxane dielectric material, a methylsilsesquioxane dielectric material, and phenylsilsesquioxane dielectric material.

47. The method according to claim 46, wherein the dielectric material is formed from a precursor that is a silicon-containing chemical compound having the formula of

$$(R_1\text{-}R_2)_n\text{-Si-}(X_1)_{4-n},$$

wherein

X_1 is hydrogen, halogen, acyloxy, alkoxy or OH group,

R_2 is an optional group and comprises an aromatic group having 6 carbon atoms and

R_1 is a substituent at position 4 of R_2 selected from an alkyl, cyclo alkyl or polycyclo alkyl group having from 1 to 13 carbon atoms, an alkenyl group having from 2 to 5 carbon atoms, an alkynyl group having from 2 to 5 carbon atoms, Cl or F; and

n is an integer 1-3.

48. The method according to claim 1, wherein the dielectric material is subjected to pre-annealing before curing.

49. The method according to claim 48, wherein the annealing is carried out by a process in which the material is subjected to electromagnetic radiation.

50. The method according to claim 49, wherein the electromagnetic radiation is selected from UV radiation, DUV radiation, Extreme UV radiation and IR radiation or a combination thereof.

51. The method according to claim 48, wherein the annealing is carried out by a process in which the material is exposed to an electron-beam

52. The method according to claim 49, wherein the dielectric material after curing is subjected to annealing in an atmosphere of air, nitrogen, argon, oxygen, hydrogen, helium, forming gas or vacuum.

53. The method of claim 48 or 52, wherein after the annealing and curing steps the dielectric material comprises less than 1 wt% of silanols.

54. The method of claim 48 or 52, wherein after the annealing and curing steps, the dielectric material is free of silanols.

55. The method according to claim 48, wherein the annealed material is subjected to the deposition of a second layer selected from a metal, a diffusion barrier, a liner, a hard mask or an additional dielectric layer.

56. The method according to claim 1, further comprising forming said dielectric material by preparing a siloxane composition by hydrolysis and condensation of selected precursors, applying the siloxane material on a substrate in the form of a layer, patterning the layer by selective exposure to electromagnetic radiation or electron beam, developing the exposed layer, followed by said curing step.

57. A method for forming a dielectric material having a dielectric constant of 2.6 or less, on a semiconductor substrate, comprising the steps of:introducing a monomeric or fully or partially polymerized deposition material on a semiconductor substrate by a spin-on or CVD method, said deposition material being formed from a precursor material comprising a silicon-containing chemical compound having the formula of

$$(R_1\text{-}R_2)_n\text{-Si-}(X1)_{4-n},$$

wherein

X_1 is hydrogen, halogen, acyloxy, alkoxy or OH group,

R_2 is an optional group and comprises an aromatic group having 6 carbon atoms and

R_1 is a substituent at position 4 of R_2 selected from an alkyl, cyclo alkyl or polycyclo alkyl group having from 1 to 13 carbon atoms, an alkenyl group having from 2 to 5 carbon atoms, an alkynyl group having from 2 to 5 carbon atoms, Cl or F;

n is an integer 1-3; and

- forming a siloxane polymer film from the deposition material on the semiconductor substrate by activating polymerization and densification reactions by a curing process;
- thereby forming a material on the semiconductor substrate having a relative dielectric constant lower than 2.6.

58. The method according to claim 1, wherein the pore size is of the nonporous dielectric material is less than 2 nm.

59. The method according to claim 1, wherein co-efficient of thermal expansion of the nonporous dielectric material is less than 35 ppm.

60. The method according to claim 1, wherein thermal decomposition temperature of the nonporous dielectric material is higher than 450 °C.

61. A densified nonporous dielectric material prepared by the method according to claim 1.

62. The material according to claim 61, having a dielectric constant of about 2.0 to 2.6.

63. An electronic device containing a densified, nonporous dielectric material prepared by the method according to claim 1.

64. The method according to claim 1, wherein the dielectric material has a dielectric constant of from 2.1 to 2.3.

65. The method of claim 1, wherein the density of the dielectric material after curing is 1.0 g/cm^3 or more.

66. The method according to claim 1, wherein an average pore size of the dielectric material is less than 2 nm.

67. The method according to claim 1, wherein a coefficient of thermal expansion of the dielectric material is less than 20 ppm.

68. The method according to claim 1, wherein a co-efficient of thermal expansion of the dielectric material is less than 15 ppm.

69. The method according to claim 1, wherein a co-efficient of thermal expansion of the dielectric material is less than 10 ppm.

70. The method according to claim 1, wherein a thermal decomposition temperature of the dielectric material is higher than 455 °C.

71. The method according to claim 1, wherein a thermal decomposition temperature of the dielectric material is higher than 460 °C.

72. The method according to claim 1, wherein a thermal decomposition temperature of the dielectric material is higher than 470 °C.

73. The method of claim 1, wherein the dielectric material is a siloxane material having a silicon oxide portion and an organic portion.

74. The method of claim 73, wherein the organic portion is selected from an aromatic ring structure and an aliphatic ring structure.

75. The method of claim 73, wherein the organic portion is an alkyl group having from 1 to 5 carbon atoms.

76. The method of claim 73, wherein the organic portion is selected from an alkenyl group having from 2 to 8 carbon atoms, an alkynyl goup having from 2 to 8 carbon atoms or an epoxy group.

77. A dielectric material prepared by the method according to claim 1.

78. The material according to claim 77, having a dielectric constant of about 2.0 to 2.6.

79. An electronic device containing a densified, dielectric material prepared by the method according to claim 1.

80. An memory device containing a densified, dielectric material prepared by the method according to claim 1.

81. An flash memory device containing a densified, dielectric material prepared by the method according to claim 1.

82. The method of claim 1, wherein the rapid thermal heating is achieved by using a heating or radiation source selected from IR radiation sources and filaments.

83. The method according to claim 82, wherein the heating or radation source is selected from tungsten lamps, ARC lamps and inductively coupled heating sources.

84. A method comprising:

- providing on a substrate a dielectric material having a first density; and
- curing the dielectric material, whereby the dielectric material is heated from a first temperature to a second temperature, to produce a dielectric material having a second density, which is greater than the first density by 20 % or more.

85. A method comprising:

- providing on a substrate a dielectric material having a first elastic modulus; and
- curing the dielectric material, whereby the dielectric material is heated from a first temperature to a second, to produce a dielectric material having a second elastic

modulus, which is greater than the first elastic modulus by an amount of 300 % or more.

86. A method comprising:

- providing on a substrate a dielectric material comprising a siloxane material; and
- curing the dielectric material whereby the dielectric material is heated from a first temperature to a second temperature, to produce a dielectric material having a coefficient of thermal expansion is less than 25 ppm.